Name: ____________________ Date: ____________

Polynomial Operations SOLUTIONS (version 26)

1. Let polynomials $p(x)$ and $q(x)$ be defined below.

$$p(x) = 8x^5 + 3x^4 + x^3 + 7x^2 - 4$$

$$q(x) = -3x^5 + 10x^4 - 8x^3 + 5x - 4$$

Express the difference $q(x) - p(x)$ in standard form.

Get "unsimplified" forms. Then find $q(x) - p(x)$ with addition/subtraction.

$$\begin{aligned}
p(x) &= (8)x^5 + (3)x^4 + (1)x^3 + (7)x^2 + (0)x^1 + (-4)x^0 \\
q(x) &= (-3)x^5 + (10)x^4 + (-8)x^3 + (0)x^2 + (5)x^1 + (-4)x^0 \\
q(x) - p(x) &= (-11)x^5 + (7)x^4 + (-9)x^3 + (-7)x^2 + (5)x^1 + (0)x^0 \\
q(x) - p(x) &= -11x^5 + 7x^4 - 9x^3 - 7x^2 + 5x
\end{aligned}$$

2. Let polynomials $a(x)$ and $b(x)$ be defined below.

$$a(x) = 6x^2 + 2x - 9$$

$$b(x) = -5x - 3$$

Express the product $a(x) \cdot b(x)$ in standard form.

You can use a table for multiplication.

*	$6x^2$	$2x$	-9
$-5x$	$-30x^3$	$-10x^2$	$45x$
-3	$-18x^2$	$-6x$	27

$$a(x) \cdot b(x) = -30x^3 - 10x^2 - 18x^2 + 45x - 6x + 27$$

Combine like terms.

$$a(x) \cdot b(x) = -30x^3 - 28x^2 + 39x + 27$$

3. Express $(x + 1)^6$ in standard (expanded) form.

Remember the binomial theorem. It tells us to use Pascal's triangle.

$$x^6 + 6x^5 + 15x^4 + 20x^3 + 15x^2 + 6x + 1$$

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4. Let polynomials $f(x)$ and $g(x)$ be defined below.

$$\begin{aligned} f(x) &= -6x^3 - 29x^2 + 7x + 18 \\ g(x) &= x + 5 \end{aligned}$$

The quotient of $\frac{f(x)}{g(x)}$ can be expressed as a polynomial, $h(x)$, and a remainder, R (a real number).

$$\frac{f(x)}{g(x)} = h(x) + \frac{R}{x+5}$$

By using synthetic division or long division, express $h(x)$ in standard form, and find the remainder R.

I prefer using synthetic division.

$$\begin{array}{c|cccc} & -6 & -29 & 7 & 18 \\ -5 & & 30 & -5 & -10 \\ \hline & -6 & 1 & 2 & 8 \end{array}$$

So,

$$\frac{f(x)}{g(x)} = -6x^2 + x + 2 + \frac{8}{x+5}$$

In other words, $h(x) = -6x^2 + x + 2$ and the remainder is $R = 8$.

5. Let polynomial $f(x)$ still be defined as $f(x) = -6x^3 - 29x^2 + 7x + 18$. Evaluate $f(-5)$.

You could do this the hard way.

$$\begin{aligned} f(-5) &= (-6)\cdot(-5)^3 \ + \ (-29)\cdot(-5)^2 \ + \ (7)\cdot(-5) \ + \ (18) \\ &= (-6)\cdot(-125) \ + \ (-29)\cdot(25) \ + \ (7)\cdot(-5) \ + \ (18) \\ &= (750) \ + \ (-725) \ + \ (-35) \ + \ (18) \\ &= 8 \end{aligned}$$

Or, if you reference the polynomial remainder theorem, you can state that you know $f(-5)$ equals the remainder when $f(x)$ is divided by $x+5$. Thus, $f(-5) = 8$.